



**Research Paper**

# Comparative economics of *Kharif*, *Rabi* and summer cultivation of tomato in Latur district of Maharashtra

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**ABSTRACT :** Tomato (*Lycopersicon esculentum*) is an important vegetable crop in India. It is also called 'love apple' is an herbaceous plant belonging to the genus *Lycopersicon* under Solanaceae or Nightshade family. The world total area under tomato is 4562438 thousand ha with production of 150513813 thousand tons and with productivity of 32.8 tons/ha in the year 2010-1011 (Source: National Horticulture Board). India is the second largest producer of vegetable in the world after China (23%) with an estimated production of 99.4 million tones, which accounts for 12 per cent of world's production. There is an increase from 596.0 thousand ha in 2006-07 to 865.0 thousand ha in 2010-11, while in terms of production it has increased from 10055.0 to 16826.0 thousand tons. In 2011-12 area is 907.0 thousand ha with production of 18653.0 thousand tons (Source: National Horticulture Board). The research have conducted to study the socio-economic characteristics of *Kharif*, *Rabi* and summer tomato growers, to compare cost and return from *Kharif*, *Rabi* and summer tomato production, to study the season-wise variety utilization and consumer preference for tomato and to study constraints and suggestions of *Kharif*, *Rabi* and summer tomato production. The studies have conducted in different Tehsils of Latur. Use of hired human labour in *Rabi* season was the highest as 236.76 man days followed by 207.00 and 177.67 man days in summer and *Kharif* season, respectively. The result revealed that total expenditure as cost-C was Rs. 127785.94 in *Rabi* season followed by Rs. 108832.31 and 105270.92 in summer and *Kharif* season, respectively. Among all the individual items of expenditure, hired human labour was predominant. The proportionate expenditure on hired human labour was the highest 28.53 per cent in summer season followed by 27.79 per cent in *Rabi* and 25.32 per cent in *Kharif* season. The results revealed that, gross return from *Rabi* season Rs. 205495.20 followed by that of Rs. 186000.00 and Rs. 176400.00 from summer and *Kharif* season, respectively. It was observed that farm business income (GR-cost-A) was 119691.63 in *Rabi* season followed by 114546.45 in summer and 107675.53 in *Kharif* season. The data clearly reveal that the average fruit weight was maximum (105g) in variety Alankar which was followed by 5005 (Lakshmi) and minimum fruit weight (60g) was observed in fruits of variety US-440. The fruits of different varieties under studies were kept for storage studies at room temperature. As the fruits of variety Alankar has recorded higher ratings for all the quality parameters under study may be the cause for preference from the growers as well as from the consumer for this variety leading to maximum area under cultivation of this variety. It was observed that one of the most important problems faced by tomato growers was timely unavailability of labour 90.63 per cent in summer season followed by 78.13 per cent and 71.88 per cent in *Rabi* and *Kharif* season, respectively.

**KEY WORDS :** *Kharif*, *Rabi*, Summer, Minimum fruit weight, Farm business income

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## INTRODUCTION :

Tomato (*Lycopersicon esculentum*) is an important vegetable crop in India. It is also called 'love apple' is an herbaceous plant belonging to the genus *Lycopersicon* under *Solanaceae* or Nightshade family. The world total area under tomato is 4562438 thousand ha with production of 150513813 thousand tons and with productivity of 32.8 tons/ha in the year 2010-1011 (Source: National Horticulture Board). India is the second largest producer of vegetable in the world after China (23%) with an estimated production of 99.4 million tones, which accounts for 12 per cent of world's production. There is an increase from 596.0 thousand ha in 2006-07 to 865.0 thousand ha in 2010-11, while in terms of production it has increased from 10055.0 to 16826.0 thousand tons. In 2011-12 area is 907.0 thousand ha with production of 18653.0 thousand tons (Source: National Horticulture Board). In 2010-11 Maharashtra contributes to about 4 per cent of the total production of tomato in the country. The state produces about 0.74 million metric ton of tomato from 0.05 million ha. having productivity of 14.2 metric ton/ha which is the third highest in the country (Source: National Horticulture Mission).

Tomato is the second most important vegetable crop next to potato but it tops the list of canned vegetables. Tomato is native to South America. It is one of the most important "protective foods" because of its special nutritive value. The major tomato producing states are Bihar, Karnataka, Uttar Pradesh, Orissa, Andhra Pradesh, Maharashtra, Madhya Pradesh and West Bengal. It is one of the most important vegetable crops cultivated for its fleshy fruits. It is considered as important and dietary vegetable crop. It is protective supplementary food. As it is a short duration crop and gives high yield, it is important from economic point of view and hence, area under its cultivation is increasing day by day.

The commonly grown varieties of tomato are Arka Abha, Arka Saurabh, Pusa Gaurav, Pant Bahar, Ratna and Rupali. Tomatoes are used in the preparation of soup, salad, pickles, puree, sauces and also consumed as a vegetable in many other ways. Green tomatoes are also used for pickles and

preserves. It has many other uses, tomato seeds contain 24 per cent oil used as salad oil and in the manufacture of margarines. Tomato is rich source of vitamins A, C, potassium, minerals and fibres and adds variety of colours and preserves.

The crop is mostly grown in Marathwada region. In Latur district total area under tomato in the year 2011-2012 is 762.16 ha with production of 15548.56 metric ton and with productivity of 20.40 metric ton/ha. Total area under tomato in the year 2012-13 is 778.58 ha with production of 16395.53 metric ton with the productivity of 21.06 metric ton/ha (Source: District Agriculture Office, Latur). The commonly grown varieties of tomato in survey area were Alankar, US-440, Laxmi-5005 (Nunhems).

Considering the importance the present study viz., "Comparative economics of *Kharif*, *Rabi* and summer cultivation of tomato in Latur district" was undertaken with the following specific objectives:

- To study the socio-economic characteristics of *Kharif*, *Rabi* and summer tomato growers.
- To compare cost and return from *Kharif*, *Rabi* and summer tomato production.
- To study the season-wise variety utilization and consumer preference for tomato.
- To study constraints and suggestions of *Kharif*, *Rabi* and summer tomato production.

## MATERIALS AND METHODS :

Multistage sampling design will be adopted in selection of district, tehsil, villages and tomato growers. At first stage, the Latur district will be purposively selected for study on the basis of highest area under tomato crop. Chakur and AUSA tehsil will be selected on the basis of higher area under tomato growers. The list of villages growing tomato in Chakur and AUSA tehsil was obtained from Tehsildar's offices. Eight villages from tehsil were selected randomly. The selected villages were namely Wadwal, Latur road, Mohnal, Kadmul in Chakur tehsil and Bheta, Borgaon, Sirsal, Killari in AUSA tehsil. From each selected village eight tomato growers were selected in such a way that four tomato growers from each of the two seasons on the basis of higher area under

tomato growers. The list was stratified into two groups *i.e.* *Kharif* and *Rabi*.

Size groups	Sample size
<i>Kharif</i>	32
<i>Rabi</i>	32
Summer	32

Thus, from eight villages, 96 growers were selected.

### Analytical techniques :

In analytical techniques, the first objective, that is to study the socio-economic characteristics of *Kharif* and *Rabi* tomato growers was achieved by tabular analysis. The second objective, that is to compare cost and return from *Kharif* and *Rabi* tomato production was achieved by tabular analysis cost concept of cost-A, cost-B, cost-C as well as cost concept of variable cost and fixed cost. The third objective, that is to study the season-wise variety utilization and consumer preference for tomato was achieved by tabular analysis and rank method. The fourth objective, that is to study constraints and suggestions of *Kharif* and *Rabi* tomato production was achieved by applying frequency and percentage method.

## RESULTS AND DATA ANALYSIS :

The findings obtained from the present study are presented below:

### Socio-economic characteristics of *Kharif*, *Rabi* and summer tomato grower :

Socio-economic characteristics and cropping pattern of tomato growers are important aspects in production of tomato crop.

Absolute mean with respect to socio-economic characteristics of tomato growers were calculated and presented in Table 1.

### Family information :

In result revealed that to average age of the *Kharif* tomato grower was higher as 44.81 years than the *Rabi* and summer grower which was 39.19 and 36.65 years, respectively. Also average family size of the *Rabi* tomato grower was found to be slight higher as 5.71 persons than that of *Kharif* and summer grower 5.46 and 5.59 persons. As far as educational level it was slightly higher as 2.77 score in *Rabi* tomato grower than that of *Kharif* and summer tomato grower 2.44 and 2.04 score, respectively. It was observed that in *Kharif*, *Rabi*

**Table 1 : Mean values of socio-economic characteristics of selected tomato growers**

Sr. No.	Particular	<i>Kharif</i> tomato	<i>Rabi</i> tomato	Summer tomato
1.	Age (years)	44.81	39.19	36.65
2.	Family size (No.)	5.46	5.71	5.59
3.	Educational level in 5 quantum score (Illiterate/Primary/ High school/ Higher secondary/ College level)	2.44	2.77	2.04
4.	Occupation level in 3 quantum score (Agriculture/ Industry/Service)	1.08	1.02	1.11
5.	Land holding (ha)	2.77	2.93	1.15
6.	Investment on Milch animal (No.)			
	Cows	1.13	1.27	1.89
	Buffalo	1.31	1.43	1.73
	Goat	0.73	0.42	0.21
7.	Bullock pair	0.92	0.96	0.86
8.	Machinery (No.)			
	Tractor	0.27	0.23	0.29
	Thresher	0.21	0.25	0.27
9.	Investment on irrigation structure (Rs.)	231208.27	263520.80	256876.45
10.	Investment on commonly used assets and farm building (Rs.)	34819.65	36856.45	32425.68

and summer tomato farmers the average of occupation level 1.08, 1.02 and 1.11 score, respectively. It was observed that in *Rabi* tomato farmers possessed higher size of land holding as 2.93 hectares than the *Kharif* and summer tomato farmers who possessed 2.77 and 1.15 hectares of land holding, respectively. It was observed that in *Kharif*, *Rabi* and summer tomato grower the average of milch animal in cows 1.13, 1.27 and 1.89 number, respectively, in buffalo 1.31, 1.43 and 1.73 number, respectively, in goat 0.73, 0.42 and 0.21 number, respectively. It observed that in *Kharif*, *Rabi* and summer tomato grower the average of bullock pair as 0.92, 0.96 and 0.86 number, respectively. It was observed that in *Kharif*, *Rabi* and summer tomato grower the average of machinery in tractor 0.27, 0.23 and 0.29 number, respectively and in thresher 0.21, 0.25 and 0.27 number, respectively. It was observed that in *Kharif*, *Rabi* and summer tomato grower the average of investment on irrigation structure as Rs. 231208.27, Rs. 263520.80 and Rs.

256876.45, respectively. Similarly, the investment on commonly used assets in *Kharif*, *Rabi* and summer tomato grower the average of Rs. 34819.65 and Rs. 36856.45 and Rs. 32425.68, respectively.

### Cropping pattern of *Kharif*, *Rabi* and summer tomato growers :

Cropping pattern of tomato was calculated and presented in Table 2. Crops grown by *Kharif*, *Rabi* and summer tomato growers were tomato, soybean, tur, cauliflower, maize, jawar, mung, udid for *Kharif* seasons and gram, cauliflower, cabbage, *Rabi* jawar, tomato, wheat, safflower for *Rabi* season and tomato, groundnut crop for summer season. The result revealed that the gross cropped area was 5.43 hectares on *Kharif* tomato growers whereas the same was 5.83 hectares on *Rabi* tomato growers and 5.67 hectares on summer tomato growers. Net sown area of *Kharif*, *Rabi* and summer tomato grower is 2.77, 2.93 and 2.89 ha, respectively. As far as cropping

**Table 2 : Cropping pattern of tomato grower**

Table 21 Cropping pattern of tomato grower							
Sr. No.	Particulars	Kharif tomato		Rabi tomato		Summer tomato	
Kharif		Area	Per cent	Area	Per cent	Area	Per cent
1.	Tomato	0.61	11.20	0.51	8.58	0.45	7.94
2.	Soybean	0.60	11.05	0.69	11.79	0.67	11.82
3.	Tur	0.38	6.98	0.36	6.22	0.32	5.64
4.	Cauliflower	0.30	5.60	0.35	6.00	0.27	4.76
5.	Maize	0.25	4.53	0.26	4.50	0.29	5.11
6.	Jawar	0.35	6.52	0.31	5.29	0.28	4.94
7.	Mung	0.17	3.15	0.24	4.22	0.19	3.35
8.	Udid	0.10	1.92	0.21	3.57	0.17	3.00
Rabi							
9.	Gram	0.34	6.21	0.40	6.86	0.31	5.47
10.	Cauliflower	0.38	6.90	0.30	5.15	0.32	5.64
11.	Cabbage	0.20	3.68	0.28	4.86	0.23	4.06
12.	Rabi jawar	0.45	8.29	0.38	6.47	0.43	7.58
13.	Tomato	0.52	9.59	0.67	11.44	0.58	10.23
14.	Wheat	0.33	6.06	0.31	5.29	0.27	4.76
15.	Safflower	0.17	3.15	0.21	3.65	0.14	2.47
Summer							
16.	Tomato	0.06	1.19	0.08	1.32	0.25	4.41
17.	Groundnut	0.22	3.99	0.29	4.79	0.50	8.82
18.	Gross cropped area	5.43	100.00	5.83	100.00	5.67	100.00
19.	Net sown area	2.77		2.93		2.89	
20.	Cropping intensivty (%)	196.03		198.98		196.19	

intensity is concerned, it was observed that the highest cropping intensity was 198.98 per cent on *Rabi* tomato grower followed by that of 196.03 per cent of *Kharif* and 196.19 per cent of summer tomato grower.

### Comparison of cost and return from tomato production :

Per hectare cost and return of production of tomato was calculated as follows.

### Physical inputs used in tomato production :

Per ha physical inputs in tomato production were estimated and are presented in Table 3. Use of hired human labour in *Rabi* season was the highest as 236.76 man days followed by 207.00 and 177.67 man days in summer and *Kharif* season, respectively. Similar trend also observed in case of use of family human labour in *Kharif*, *Rabi* and summer season 42.23, 45.76 and 37.45 man days, respectively. The highest bullock labour was utilized in *Rabi* season was 8.46 pair day followed by summer and *Kharif* season was 7.25 and 6.05 pair day. Use of machine in *Kharif*, *Rabi* and summer season

was 5.17, 4.68 and 3.43 hour, respectively. The highest seeds was utilized in summer season 184.23 g, followed by *Kharif* and *Rabi* season grower 88.00 and 80.00 g, respectively. Use of seedlings in *Kharif* and *Rabi* season grower was 10333.33 and 14243.90 number, respectively. No seedling observed in summer broad by farmer. At overall level use of manures in *Kharif* farmer was 32.65q. No manure added by farmer in *Rabi* and summer due to non-availability of manure observed regard to all cultivar *Rabi* and summer. In regards to nitrogen, phosphorus, potash *Rabi* season use is highest 99.43, 49.65, 42.45 kg, respectively followed by *Kharif* season 98.57, 48.34, 37.35 kg, respectively and *Rabi* season 93.28, 38.65, 47.74 kg, respectively. On a use of fertilizer in *Kharif*, *Rabi*, summer season was 184.26, 191.53 and 179.67 kg, respectively. Use of plant protection in *Kharif*, *Rabi* and summer season was 2.30, 2.10 and 2.4 lit, respectively. Use of bamboo, wire, sutali *Kharif* season is highest 2500 number, 2.35 q, 2.5 q, respectively followed by *Rabi* season 2400 number, 2.12 q, 2.3 q, respectively and summer season 1900 no., 1.9 q, 2.1q, respectively. On a use of staking in

Table 3 : Per hectare physical inputs and outputs of tomato production					(Unit/ha)
Sr. No.	Particular	Unit	<i>Kharif</i> tomato	<i>Rabi</i> tomato	Summer tomato
<b>Input</b>					
1.	Hired human labour	Man day	177.67	236.76	207.00
2.	Bullock labour	Pair day	6.05	8.46	7.25
3.	Machine	Hour	5.17	4.68	3.43
4.	Seeds	gm	88.00	80.00	184.23
5.	Seedlings	No.	10333.33	14243.90	
6.	Manure	Q	32.65		
7.	Fertiliser	kg			
	N		98.57	99.43	93.28
	P		48.34	49.65	38.65
	K		37.35	42.45	47.74
<b>Sub total</b>			184.26	191.53	179.67
8.	Plant protection	lit	2.30	2.10	2.4
9.	Staking				
	Bamboo	No.	2500	2400	1900
	Wire	Q	2.35	2.12	1.9
	Sutali	Q	2.5	2.3	2.1
	Sub total		2504.85	2404.42	1904
10.	Irrigation	m <sup>3</sup>	1052.88	1340.2	2285
11.	Family human labour	Man day	42.23	45.76	37.45
<b>Output</b>					
12.	Tomato yield	Q	220.50	285.41	155.00

*Kharif*, *Rabi*, summer season was 2504.85, 2404.42, 1904, respectively. The application of irrigation was highest in summer season 2285 m<sup>3</sup> followed by *Rabi* 1340.20 m<sup>3</sup> and *Kharif* 1052.88 m<sup>3</sup>. In regard to per hectare yield in *Kharif*, *Rabi*, summer season 220.50, 285.41, 155.00 quintal, respectively. Thus, it implied that per ha use of input as well as their output in *Rabi* season was higher than *Kharif* and summer.

#### Cost of production of tomato crop :

Per hectare item wise expenditure in tomato production was estimated and presented in Table 4. The result revealed that total expenditure as cost-C was Rs. 127785.94 in *Rabi* season followed by Rs. 108832.31 and 105270.92 in summer and *Kharif* season, respectively.

Among all the individual items of expenditure, hired human labour was predominant. The proportionate expenditure on hired human labour was the highest 28.53 per cent in summer season followed by 27.79 per cent in *Rabi* and 25.32 per cent in *Kharif* season. The

proportionate of family human labour was highest in *Kharif* 6.02 per cent followed by 5.37 and 5.16 per cent in *Rabi* and summer season, respectively. In the next order the item of rental value of land was found important one in which proportionate expenditure was 28.44 per cent in summer season followed by 27.87 and 26.76 per cent in *Kharif* and *Rabi* season, respectively. It is clear that items of irrigation were important item of expenditure. The proportionate share of irrigation was 7.24 per cent in summer followed by 3.62 per cent and 3.45 per cent in *Rabi* and *Kharif* season, respectively. It is obvious that other items of expenditure showed minor proportions. Thus, on average expenditure on cost-A was 67.15 per cent in *Rabi* season followed by 65.65 per cent and 65.28 per cent in summer and *Kharif* season, respectively. The proportionate expenditure on cost-B was found 94.84 per cent in summer season followed by 94.63 per cent and 93.98 per cent in *Rabi* and *Kharif* season, respectively.

Table 4 : Per ha item wise expenditure in tomato production						(Rs./ha)	
Sr. No.	Input	<i>Kharif</i> tomato		<i>Rabi</i> tomato		Summer tomato	
			Per cent		Per cent		Per cent
1.	Hired human labour	26650.5	25.32	35514	27.79	31050.00	28.53
2.	Bullock labour	2420	2.30	3384	2.65	2900.00	2.66
3.	Machine labour	2585	2.46	2340	1.83	1715.00	1.58
4.	Seed	3080	2.93	7040	5.51	7184.97	6.60
5.	Seedling	5166.67	4.91	9970.73	7.80		
6.	Manure	1893.7	1.80				
7.	Fertilizer						
	N	1267.61	1.20	1278.67	1.00	1199.58	1.10
	P	2417	2.30	2482.5	1.94	1932.50	1.78
	K	1057.01	1.00	1201.34	0.94	1351.04	1.24
	Sub total	4741.62	4.50	4962.50	3.88	4483.12	4.12
8.	Plant protection	1926.3	1.83	1850.00	1.45	2200.43	2.02
9.	Land revenue	58.54	0.06	52.24	0.04	49.38	0.05
10.	Staking (Bamboo/wire/sutali)	14226	13.51	13179.2	10.31	11584	10.64
11.	Irrigation	3632.44	3.45	4623.69	3.62	7883.25	7.24
12.	Interest on working capital @13%	2157.37	2.05	2694.78	2.11	2220.17	2.04
13.	Depreciation on capital assets	186.34	0.18	192.43	0.15	183.23	0.17
14.	Cost-A	68724.47	65.28	85803.57	67.15	71453.55	65.65
15.	Rental value of land	29341.46	27.87	34196.96	26.76	30950.62	28.44
16.	Interest on fixed capital @10%	870.49	0.83	921.41	0.72	810.64	0.74
15.	Cost-B	98936.42	93.98	120921.94	94.63	103214.81	94.84
16.	Family human labour	6334.5	6.02	6864	5.37	5617.5	5.16
17.	Cost- C	105270.92	100.00	127785.94	100.00	108832.31	100

**Profitability of tomato production :**

Per hectare profitability of tomato production was calculated and presented in Table 5. The results revealed that, gross return from *Rabi* season Rs. 205495.20 followed by that of Rs. 186000.00 and Rs. 176400.00 from summer and *Kharif* season, respectively. It was observed that farm business income (GR-cost-A) was 119691.63 in *Rabi* season followed by 114546.45 in summer and 107675.53 in *Kharif* season. It was observed that family labour income (GR-cost-B) Rs. 84573.26 in *Rabi* season followed by Rs. 82785.19 and Rs. 77463.58 from summer and *Kharif* season, respectively. It was observed that net profit (GR-cost-C) that was Rs. 77709.26 in *Rabi* season followed by Rs. 77167.69 in summer and Rs. 71129.08 in *Kharif* season, respectively. It was found that output- input ratio in summer, 1.80 followed by 1.68 and 1.61 in *Kharif* and *Rabi*.

**Season-wise variety utilization and consumer preference for tomato physiological weight loss and shelf-life :**

The data regarding performance of different variety tomato under study with respect to physiological weight loss and shelf-life of fruit is presented in Table 6. The data clearly reveal that the average fruit weight was maximum (105g) in variety Alankar which was followed by 5005 (Lakshmi) and minimum fruit weight (60g) was observed in fruits of variety US-440. The fruits of different varieties under studies were kept for storage studies at

room temperature.

It is observed that physiological weight loss was maximum in variety US-440 and it was (11.2%) at fifth days of storage while variety 5005 (Lakshmi) recorded significantly minimum loss (5.88%) at fifth days of storage. The variety Alankar and 5005 (Lakshmi) did not show significance differences in weight loss on seventh days of storage and they recorded (9.52%) and (9.11%) weight loss, respectively. Regarding shelf-life of tomato fruits it is observed that the minimum shelf-life (5 days) was recorded in variety US-440 while it was maximum shelf-life (10 days) in variety Alankar. This clearly shows that the fruit of variety fruit of variety Alankar has more shelf-life as compared to other varieties under study.

**Organoleptic test of tomato fruits :**

The fruit of different varieties were tested by organoleptic test which was based on different fruit quality parameters like appearance, colour, size, weight of fruit, peel thickness and test in which each parameter was given ten marks. the scoring for this parameter was made as excellent 10 point, best 9 point, better 8 point, good 6 point, average 5 point, poor less than 5 point. The fruit samples were judged by a group of 10 different judges belonging to different age, sex and socio-economic groups.

The average were worked out and presented in Table 7. The data showed that the fruits of variety Alankar as recorded maximum total score (45.4) for all the

**Table 5 : Per hectare profitability of tomato production**

Sr. No.	Returns	<i>Kharif</i> tomato	<i>Rabi</i> tomato	Summer tomato
1.	Gross returns	176400.00	205495.20	186000.00
2.	Cost-A	68724.47	85803.57	71453.55
3.	Cost-B	98936.42	120921.94	103214.81
4.	Cost-C	105270.92	127785.94	108832.31
5.	Farm business income (GR-Cost-A)	107675.53	119691.63	114546.45
6.	Family labour income (GR-Cost-B)	77463.58	84573.26	82785.19
7.	Net profit (GR-Cost-C)	71129.08	77709.26	77167.69
8.	Output-input ratio (GR-Cost-C)	1.68	1.61	1.80

**Table 6 : Performance of different tomato varieties in respect of PLW (physiological wt. loss) and shelf-life**

Sr. No.	Varieties	Initial wt. of four fruits (g)	Days of storage							Shelf-life (Days)
			1	2	3	4	5	6	7	
1.	US-440	240	236 (1.6)	230 (4.1)	224 (6.6)	219(8.7)	213 (11.2)	208 (13.3)	203 (15.4)	5
2.	5005	340	337 (0.88)	333(2.05)	332(2.35)	324(4.70)	320(5.88)	315(7.35)	309 (9.11)	7
3.	Alankar	420	416(0.95)	412(1.90)	407(3.09)	401(4.5)	394(6.1)	387(7.85)	380 (9.52)	10

Figures in parenthesis indicate per cent loss in weight

parameters under study and recorded average score of 9.08 which was followed by the fruits of variety 5005 (Lakshmi) total score (36.5) and average score of 7.30 the minimum total score (35.9) and average score was recorded (7.18) in fruits variety US-440 as this the variety has shown poor performance with respect to size, shape and weight, peel thickness and test. As the fruits of variety Alankar has recorded higher ratings for all the quality parameters under study may be the cause for preference from the growers as well as from the consumer for this variety leading to maximum area under cultivation of this variety.

### Constraints and suggestions tomato grower :

#### Constraints of tomato grower :

Constraints of *Kharif* and *Rabi* tomato grower in the frequency and per cent were calculated and are presented in Table 8. It was observed that one of the most important problem faced by tomato growers was

timely unavailability of labour 90.63 per cent in summer season followed by 78.13 per cent and 71.88 per cent in *Rabi* and *Kharif* season, respectively. The next important problem faced by the farmers was timely unavailability of fertilizers and pesticides which was reported by 56.25 per cent in *Kharif* season followed by 46.88 per cent and 37.5 per cent in *Rabi* and summer season, respectively. The problem such as lack of technical knowledge about pest and diseases and its control measures was reported by 53.13 per cent, 46.88 per cent and 37.50 per cent in summer, *Kharif* and *Rabi* season, respectively. For cultivation of tomato it requires high investment, the timely unavailability of loan, which was faced by 50 per cent, 43.75 per cent and 34.38 per cent in *Kharif*, *Rabi* and summer season, respectively. It was observed that unavailability of water at stress situation in summer, *Rabi* and *Kharif* season was 87.5 per cent, 68.75 per cent and 9.37 per cent, respectively.

**Table 7 : Cumulative score of organo-leptic test of tomato fruits of different varieties**

Sr. No.	Varieties	Parameters					Total (50)	Average
		Appearance (10)	Colour (10)	Size, shape and weight (10)	Peel Thickness (10)	Taste (10)		
1.	US-440	7.5	7.6	7	6.9	6.9	35.9	7.18
2.	5005	7.5	7	7.5	7.4	7.1	36.5	7.3
3.	Alankar	9.3	9.1	9.5	9.3	8.2	45.4	9.08

**Table 8 : Constraints and Suggestions of tomato production**

Table 1. Constraints and Suggestions of tomato production							
Sr. No.	Particular	Kharif		Rabi		Summer	
		Frequency (n=32)	Per cent	Frequency (n=32)	Per cent	Frequency (n=32)	Per cent
Constraints							
1.	Timely unavailability of labour	23	71.88	25	78.13	29	90.63
2.	Timely unavailability of fertilizer and pesticide	18	56.25	15	46.88	12	37.5
3.	Lack of technical knowledge about pest and diseases and its control measures	15	46.88	12	37.50	17	53.13
4.	Timely unavailability of loan facilities	16	50	14	43.75	11	34.38
5.	Unavailability of water at stress situation	3	9.37	22	68.75	28	87.5
Suggestions							
1.	Provision of labour through employment guarantee scheme by government	18	56.25	21	65.63	26	81.25
2.	District administration should make necessary arrangement to get timely fertiliser to tomato grower	13	40.63	15	46.88	12	37.5
3.	Arrange training by agricultural department /university	15	46.88	10	31.25	14	43.75
4.	NABARD and banks make the provision to supply credit availability at minimum interest	12	37.5	12	37.50	8	25
5.	Use water conservation practices must be followed with use of drip irrigation	3	9.375	18	56.25	23	71.88



**Suggestions of tomato grower :**

It was observed that suggestion of provision of labour through employment guarantee scheme by government was 81.25 per cent, 65.63 per cent and 56.25 per cent in summer, *Rabi* and *Kharif* season, respectively. The suggestion about district administration should make necessary arrangement to get timely fertilizers to tomato grower was 46.88 per cent, 40.63 per cent and 37.5 per cent in *Rabi*, *Kharif* and summer season, respectively. The next suggestion was the arrange training by agricultural department and universities was 46.88 per cent, 43.75 per cent and 31.25 per cent in *Kharif*, summer and *Rabi* season, respectively. The suggestion about the provision to supply credit availability at minimum interest rate NABARD and other banks to farmers was 37.5 per cent, 37.5 per cent and 25 per cent in *Kharif*, *Rabi* and summer season, respectively. The suggestion of the water conservation practices must be followed with use of drip irrigation was 71.88 per cent, 56.25 per cent and 9.375 per cent in summer, *Rabi* and *Kharif*

season, respectively.

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